

### What Is Claimed Is:

1. A method for evaluating, during a welding process, a welded joint as it is forming between at least two parts of a joint using at least one ultrasonic transmitter penetrating the region of the forming welded joint with ultrasonic waves and at least one ultrasonic receiver, which registers the changes in sound transmittance of the ultrasonic waves penetrating the region of the forming welded joint in order to evaluate the welded joint,

**wherein** sound is transmitted with longitudinal (l) and transverse(t) ultrasonic waves into the region of the welded joint,

the time-dependent changes in sound transmittance  $D_l(t)$ ,  $D_t(t)$  of the longitudinal ultrasonic waves (l) and the transverse ultrasonic waves (t) are registered separately, and

using the ratio of  $D_l(t)$  to  $D_t(t)$ , the time point  $t_s$  at which a molten mass forms in the region of the welded joint is determined and which serves as a basis for evaluating the welded joint.

2. The method according to claim 1,

**wherein** the time point  $t_s$  at which a molten mass forms in the region of the welded joint between the parts of the joint is determined by the time point of the time-dependent ratio function of  $D_l(t)$  to  $D_t(t)$ , at which the ratio function indicates a big leap in rising, is determined.

3. The method according to claim 1 or 2,

**wherein** the at least one ultrasonic transmitter transmits ultrasonic waves into a first part of a joint via a contact area and

the at least one ultrasonic receiver registers ultrasonic waves transmitted into the region of the welded joint via a contact area of a second part of the joint,

the following time-dependent ratio function is utilized to evaluate the welded joint:

$$\frac{D_l(t)}{D_t(t)} = \frac{(EB)_l(t) \cdot (BB)_l(t) \cdot (BI)_l(t) \cdot (BE)_l(t)}{(EB)_t(t) \cdot (BB)_t(t) \cdot (BI)_t(t) \cdot (BE)_t(t)} \approx \frac{(EB)_l^2(t) \cdot (BB)_l(t)}{(EB)_t^2(t) \cdot (BB)_t(t)} \approx \frac{(BB)_l(t)}{(BB)_t(t)}$$

with  $(EB)_{l \text{ or } t}(t) \equiv$  sound transmittance of longitudinal waves or transverse waves at the sound coupling - in area on the first part of a joint  
 $(BB)_{l \text{ or } t}(t) \equiv$  sound transmittance of longitudinal waves or transverse waves at the contact between the parts of a joint  
 $(BI)_{l \text{ or } t}(t) \equiv$  sound transmittance of longitudinal waves or transverse waves inside the parts of a joint  
 $(BE)_{l \text{ or } t}(t) \equiv$  sound transmittance of longitudinal waves or transverse waves at the sound coupling out area on the second part of a joint

with  $(BI)_{l \text{ or } t}^2(t)$  and  $(EB)_{l \text{ or } t}^2(t)$  of the longitudinal waves and the transverse waves being largely the same provided that frequencies are low and the transmission paths are short.

4. The method according to claim 3,  
**wherein** the evaluation of the welded joint is based on the size of the forming molten mass which is determined from the degree of difference in the rise of the ratio function at the time point  $t_s$ .

5. The method according to one of the claims 1 to 4,  
**wherein** the welding is conducted as part of a resistance welding process in which contact electrodes are placed on the parts of the joint, the contact electrodes forming contact areas with the parts of the joint via which the ultrasonic waves are coupled in, respectively coupled out.

6. The method according to one of the claims 1 to 4,  
**wherein** the welding process is conducted as part of a noncontact welding process in which the ultrasonic transmitter and the ultrasonic receiver are brought in direct contact with the respective part of the joint.

7. The method according to claim 6,  
**wherein** laser beam, electron beam or ion beam welding is used as the noncontact welding process.
8. The method according to one of the claims 1 to 7,  
**wherein** piezoelement probes or EMUS probes are used as the ultrasonic transmitter and the ultrasonic receiver
9. The method according to one of the claims 1 to 8,  
**wherein** standard values are generated by means of an online evaluation of the forming welded joint which influence the welding process.